

Royal Canadian Institute

1915-16

(10)



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The following is submitted in response to the President's request for (a) a report on the plan put forward by the Royal Canadian Institute in a pamphlet entitled "Bureau of Scientific and Industrial Research and School of Specific Industries of the Royal Canadian Institute: (b) a report on the work done by this Faculty to promote the application of Science to Industry, and (c) suggestions for extending this work.

In this report the term "applied science" is used in a special sense. The Faculties of Agriculture, Medicine, Dentistry, Veterinary Science, and Forestry deal with the applications of science to the industries with which they are connected: the application of science to all other industries is, in this University, dealt with by the Faculty of Applied Science and Engineering, and throughout this report the term "applied science" is not intended to include the application of science to the subjects entrusted to the five other bodies named.

*2/27* (a) The plan put forward by the Rgy. Can. Inst.

As explained below, there are two methods by which universities or other public bodies may promote the application of Science to Industry, viz:- (i) by the investigation of industrial problems of general interest to the State or to all engaged in some particular industry, and (ii) by the investigation of problems of immediate interest to some individual manufacturer, on the understanding that the results obtained will be his private property, or will in the first instance at least be available only to him, for his personal pecuniary advantage. The R. C. I. plan deals with investigations of the second class only; and contemplates the establishment by individual manufacturers of paid "fellowships," the holders of which (under competent direction) will work on problems of commercial interest to the individuals who found the fellowships.

This plan is stated in the pamphlet to be in "imitation of the Mellon Institute of Pittsburgh." It differs, however, from the plan in operation at that Institution in two important particulars. #

# Foot Note: The exact conditions under which work in connection with the R. C. I. is to be carried out in the University laboratories are not



(a) According to the R. C. I. plan, negotiations with the manufacturer who provides the funds will be carried out by an officer of the R. C. I. (who is, in fact, "already conducting negotiations with several firms"), while the responsibility for obtaining results satisfactory to the manufacturer will fall on officers of the universities, i. e. on the professors in whose laboratories and under whose direction the investigation is to be carried out. Put briefly, promises are to be made by one body which it is left to the other to perform. There is no such divided responsibility in the Mellon Institute. Unless and until the R. C. I. has laboratories, staff and equipment of its own, the most it can do in this direction is to introduce the manufacturer to the proper University authority and leave the two to make their own arrangement.

(b) According to the R. C. I. pamphlet, any funds that may be collected by the R. C. I. for the purposes of their Bureau, over and above the amount stipulated for the salaries of fellows and the provision of material used by them, will not be handed over to the universities where the work is

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made plain in the pamphlet. The University is spoken of as an "instrumentality;" we are told that the R. C. I. "in its investigations will look to the assistance of the universities wherever it is available," and again "we will be in touch with that university which can supply the best man and means and laboratory for the solution of the problem." In the "Constitution and By-Laws" we read: "There shall be a Director of the Bureau .....  
..... to organize, carry on and direct the work of the Bureau;" this section might be taken to imply that work carried out in the laboratories of the University would be "carried on and directed" by an Officer of the R. C. I. In its discussion of the R. C. I. proposals in this report, the Council assumes that no such implication was intended; they regard it as essential that any person working in a University laboratory should do so under the superintendence of and subject to the directions of the head of the laboratory.



done to recoup them for "overhead" costs and for incidental expenses occasioned by the work done, or to enable them to increase their staffs or their laboratory facilities; on the contrary, such moneys will be retained by the R. C. I., and will be expended by them "to provide for the salaries and outgoings necessary for organizing and carrying on the work of the Bureau, to provide the necessary buildings and premises for housing the library", (at present housed free by this University) "the Bureau and its work, in which building provision shall be made for housing and carrying on the work of the R. C. I. not provided for in the Bureau," and "to provide an endowment or fund for the perpetuation of the Bureau and its work."

In other words, while the work is to be done in the universities, any fund that may be built up will be the property of an outside organization. There is no such division of interests in the Mellon Institute; work done there enhances the reputation of the institution and staff that carry out the work, and any funds that this reputation may attract are used to build up the staff and facilities of the institution where investigations are made.

As detailed later in this Report, a not inconsiderable amount of the kind of work contemplated by the R. C. I. has already been done and is now being done in the laboratories of this <sup>University</sup> Faculty. Any considerable extension of this work will involve increased expenditure, whether it be done under the R. C. I. plan or under any other plan, but it would be a most uneconomical use of public funds to spend them on purchasing land and erecting, heating and maintaining laboratories and supporting the clerical and scientific staff of a new institution.

The importance of the commercial results obtained by the application of science to industry is generally recognized, and need not be emphasized here. That there is, in fact, a tendency to overestimate the importance of this factor in commercial success, may be seen from the numerous newspaper articles published in the last eighteen months urging the chemists of England (or of America, or Canada, as the case may be) to discover "the secrets of the aniline dye manufacture" - the fact being that the establishment of a dye-stuffs industry is a purely commercial proposition, depen-



dent for its success mainly on the availability of raw material and the provision of efficient protection against foreign dumping; the details of manufacture of most of the dyes in common use being thoroughly understood, and not being protected by patents even in time of peace.

The great amount of time and labour usually needed for the successful application of the principles of science to a concrete business proposition is, on the other hand, generally underestimated, except by those who have been personally engaged in such work. As Edison puts it: "In this field genius is about 2 per cent inspiration and 98 per cent perspiration."

Such work requires time, laboratory facilities and trained experienced men. In Germany, just before the war, there was one university-trained chemist for every 15 men engaged in the extensive chemical industry of that country, and in German industry as a whole the ratio was one to every 40 men employed; in England, as Dr. Peddie tells us, there was but one to every 500 men engaged in the various industries, and in Canada the proportion must be even less.

In Canada very few of the industries have properly equipped laboratories of their own, and there are only two or three well supplied commercial consulting laboratories to which they may apply for temporary assistance. It is therefore natural that advice is commonly sought from members of ~~this Faculty~~ <sup>the University</sup> and of ~~corresponding bodies in other universities~~. Such advice and assistance is readily given whenever possible; for it is to the direct interest of the universities that those engaged in teaching applied science should keep in close touch with the realities of commercial life.

7 (6) There is, consequently, a considerable amount of work of this nature carried out in the laboratories of ~~this Faculty~~ <sup>the University</sup>; for the purpose of this report it may be dealt with under two heads.



1. THE APPLICATION OF SCIENCE TO PROBLEMS OF INTEREST TO THE STATE OR TO  
A WHOLE INDUSTRY

Such, for instance, are the exhaustive study of the mechanical properties of steel and the alloys, carried out by the German government at Gross-Lichterfelde; the elaborate investigation of the problems of tanning and leather manufacture carried out by the Leather Sellers Guild in London; and the important experimental work on the "cracking" of petroleum and the extraction of radium now in progress under the Bureau of Mines of the United States.

Work of this class done in the laboratories here is necessarily on a more modest scale; and idea of its amount and nature may be gained from the following partial list of investigations carried out in the laboratories of this Faculty during the last few years.

LIST NO. 1.

The experimental work involved in the investigations enumerated above was carried out by members of the staff, usually with the co-operation of students or junior assistants. Many minor investigations have been completed by graduate students or by undergraduates in connection with the preparation of their theses for the degree. The problems are often suggested by the student's vacation experience in the factory or the mine and a successful result, when obtained, usually leads to permanent employment. The work, however, is not paid for, and the results may be published. A few examples may be quoted:-

Rubber: A student who had spent his vacation in a rubber works, on returning to the laboratory, studied the methods of analysis and improved on one of them. He obtained a position with the company. This case is typical of half a dozen others.

Wood distillation: Four students on different occasions made a chemical study of certain by-products of the manufacture of wood alcohol, which at that time were regarded as waste products, and for the most part burned. Two of them obtained positions with a wood distilling company.

Spirits: A student examined the fusel oil from a large distillery and isolated a number of its constituents. The results were published in the Journal of Industrial and Engineering Chemistry. This man is now the Technical Director of the distillery.

Coal Gas by-products: A student who in his fourth year tried out some proposed new methods for extracting ferrocyanides from gas-house waste, obtained results of commercial importance, and is now Chief Chemist of a large manufacturing company.

This list could be extended to include an account of similar work on sugar, starch, sulphate of ammonia, synthetic drugs (van-



illin, antipyrine, phenol, picric acid, etc.) paper pulp, coal gas, synthetic ammonia, formaldehyde, oils and fats, etc. etc. but those detailed above are sufficient to show the nature of the problems attacked. In some cases results were obtained, in others not.

Shortly before the war broke out the Engineering Alumni Association of this University founded two scholarships for industrial research. One of these in the Department of Electrical Engineering after two years experimental research, yielded results of first rate importance regarding the operation of the hydro-electric 110,000 volt transmission lines; and as a result, after consultation with Dept. of Electrical Engineering, the investigator was appointed engineer-in-charge of the laboratories of the Hydro-Electric Power Commission of Ontario. The other, which dealt with the recovery of resinous products from wood, was less successful. Financial conditions arising out of the war have led to the temporary suspension of these fellowships.

Suggestions for the extension of this work.

Any considerable extension of this work will necessitate provision for relieving members of the teaching staff of some of their present duties, and in some departments will require the provision of additional laboratory facilities. In other words, it will involve expense. Some of this additional expense might very properly be shared by the Dominion or Provincial Government.

(A) Co-operation with the Dominion Government:- The Dominion Government has already supplied funds for a study of the coals of Canada at McGill University, for the development of commercial uses of cobalt at Queen's and for a study of the clays of Canada here. By co-operation in this way the Government secures at minimum cost the use of laboratory facilities and apparatus and the assistance of a trained staff; in particular they secure the opportunity of attracting the attention of students of Applied Science to problems of the greatest importance to the country. In the case of the ceramics laboratory, until recently established in Toronto, there was the additional advantage that this city is the head of the clay industries of the Dominion; the decision to remove the laboratory to Ottawa is for every reason much to be regretted.



There is at present in Canada no institution corresponding to the German "Reichsanstalt," or the to the "Bureau of Standards" of the United States Government. The establishment of such institutions has been found necessary by all the large industrial countries of the world, but in Canada questions of expense and situation, the difficulty of obtaining a suitable staff, and other reasons have caused delay. In the opinion of this Council, better results would be obtained by establishing Branches of such a Dominion Bureau at the University of Toronto and at McGill University than by founding an isolated Institute at Ottawa. The equipment of the universities would then become immediately available, an economical beginning could be made, and as the importance of the results became recognized the scale of the undertaking and the expenditure on it could be increased. Apart from the saving in money, this plan has the advantage over the establishment of an isolated institution, that it would offer guidance and inspiration to the young men now being trained in Science, by whom, after all, the practical applications of science to the individual industries of the country must be made.

The establishment of such a Branch here seems the best way in which the Dominion Government could co-operate with this University in promoting the application of Science to Canadian Industry.

*Page 9*  
(B) Co-operation with the Bureaus of the Government of Ontario:-

An attempt might be made to establish closer relations with the Provincial Bureau of Health (the Director of which is a Professor in this Faculty,) with the Provincial Bureau of Mines, and with the newly established laboratories of the Hydro-Electric Commission.

(C) The provision of Research Assistants or Fellows might be considered by the University, the holders of which, under the direction of members of the staff, could carry to completion industrial researches already begun here, or others which could not be undertaken for lack of such assistance. This suggestion does not imply the immediate establishment of a large number of such assistantships, or that such as might be established should be allotted according to any symmetrical scheme. A plan of this kind has been found to work well in certain of the universities of the United States; at the University of Illinois, for instance, where an "Engineering Experiment Station" conducted by the University has been in successful operation since 1904, and has already published 80 Bulletins



on "problems of importance to professional engineers and to manufacturing, railway, mining, constructional and industrial interests of the State."

THE APPLICATION OF SCIENCE TO PROBLEMS OF INTEREST TO INDIVIDUAL MANUFACTURERS OR CORPORATIONS ENGAGED IN INDUSTRIAL PURSUITS.

Owing to the absence of large suitably equipped commercial laboratories in this country which will probably not be provided until the manufacturers have been educated up to the necessity for them, it is obviously desirable that members of the Faculty of Applied Science, with the equipment at their disposal, should help in the application of science to the problems of the individual manufacturer - using that term in its widest sense. It is also clear that the manufacturer so helped ought to make some payment for the assistance received; more particularly because, as a usual thing, he objects to the publication of the results obtained, for fear that details of his business might thus become available to competitors.

In so far as they undertake work of this nature, the members of the Faculty constitute a body of skilled advisers whose assistance is available at low cost to the industries of the country.

The following incomplete list will give an idea of the nature and extent of the work so performed; because of the special interest attached to them, investigations arising out of the situation created by the war are placed at the head of the list.

List No. II.

Suggestions for the extension of this work.

It should be clearly understood from the outset, that if work of this class is to be materially extended, additional funds will be needed.

The E. C. I. Plan:- As already pointed out, the plan put forward by the R. C. I. differs from that in operation at the Mellon Institute, in that the Mellon Institute is an integral part of the University of Pittsburgh, while the R. C. I. Bureau is to be an independent body, looking to the universities for assistance in its work. The inconveniences arising out of this arrangement have been discussed already; in the present connection it is only necessary to point out that although under this plan the manufacturer would pay the salary of the investigator and provide him with material, the University would be expected to provide free of cost laboratory accommodation and facilities, as well as the time of its senior



professors. To suppose that a serious investigation could be carried out by a young graduate at a small salary, independent of advice and assistance from those of more experience is absurd, and the more work of this kind is undertaken, the larger will be the staff required. In the University of Pittsburgh of which the Mellon Institute is an integral part, the Department of Chemistry includes 14 professors, 13 assistant professors and 10 instructors; and the laboratory accommodation and facilities used for research alone are said to have cost over half a million dollars.

Undergraduate Students:- It might be thought that the investigation of the manufacturers' problems could be entrusted to senior undergraduate students in connection with the preparation of their theses for the degree and could in this way be undertaken without entailing any new expense on the laboratories. It must be remembered, however, that such students would not be in a position to devote all their time and attention to the problem supplied; only part of their laboratory hours is available for thesis work, and much of their attention would be taken up with the other subjects of their final examination.

Moreover, it is an essential feature of all paid work that he who pays expects definite results in a fixed time; so that if the results were not being obtained quickly enough by an undergraduate investigator, it would be almost necessary for some instructor to take the matter out of the student's hands, and reduce him to the position of a mere workman. Additional labour and anxiety would thus be thrown on the instructor, while the student would lose his opportunity of learning to carry on independent research, and with it the main benefit to be derived from his final year in the University.

The plan of avoiding expense by leaving the work to undergraduates must therefore be rejected.

X Assistance from the Dominion Government:- In view of the interest in Industrial Research displayed by the Minister of Trade and Commerce an attempt might be made to procure funds for this purpose from the Dominion Government. Suggestions for the formation of a Royal Commission to carry on work of this kind in co-operation with the universities have already been laid before him, and these representations might be renewed.



UNIVERSITY OF TORONTO  
PHYSICS.

Feb. 2nd 1906

Dear President Holmes:

I am going out of town for the day just this morn-  
a time before 9 o'clock is beyond  
to the purchase of the A.P.O. that  
the money I have always followed  
since I became head of the school  
I am in negotiation with  
many different departments  
accredited bodies and with  
medical societies these  
and others in the physical  
laboratory as the physical

Education Institute  
along with the school  
and the school  
and the school

Physical

Physical



at Washington.

It seems to me that we should first of all take as wide a survey as possible of what ~~there~~ are the needs of our country, prepare a scheme to meet them, and then consider how best to carry out the plan.

Our Government should take to heart a new situation of things. We should not then propose anything but a greater consideration of the people's needs, and a more direct and efficient way of carrying out the plan.

The necessity of a laboratory available for the purpose of the enclosed such bodies as individuals wish to carry out.

In regard to the proposal to institute a national scheme of universal enclosures, I may perhaps be permitted to point out that when Germany, England and the United States each inaugurated a similar movement - they began by establishing a National Enclosure Laboratory. - The Reichsanstalt at Charlottenberg, the Kaiserliche Versuchsanstalt at Jeddburgh and the Bureau of Standards



REPORT ON THE PLAN FOR FORWARDED BY THE

ROYAL CANADIAN INSTITUTE IS A PAMPHLET

ENTITLED "BUREAU OF SCIENTIFIC AND

INDUSTRIAL RESEARCH AND SCHOOL OF SPECIAL

INVESTIGATION OF THE ROYAL CANADIAN INSTITUTE.

February 21st, 1910.



REPORT ON THE PLAN PUT FORWARD BY THE ROYAL CANADIAN  
INSTITUTE IN A PAMPHLET ENTITLED "BUREAU OF SCIENTIFIC  
AND INDUSTRIAL RESEARCH AND SCHOOL OF SPECIFIC INDUSTRIES  
OF THE ROYAL CANADIAN INSTITUTE."

At a meeting of members of the staff in Science and Applied Science of the University of Toronto called to consider the proposal of the Royal Canadian Institute with regard to the establishment of a Bureau of Industrial Research it was resolved:

That in the opinion of this meeting the proposal of the Royal Canadian Institute as set forth in its printed circular is not feasible for the following reasons.

The Faculty of Applied Science deal with the proposal as follows:

There are two methods by which universities or other public bodies may promote the application of Science to Industry, viz:-  
(i) by the investigation of industrial problems of general interest to the State or to all engaged in some particular industry, and (ii) by the investigation of problems of immediate interest to some individual manufacturer, on the understanding that the results obtained will be his private property, or will in the first instance at least be available only to him, for his personal pecuniary advantage. The Royal Canadian Institute plan deals with investigations of the second class only; and contemplates the establishment by individual manufacturers of paid "fellowships", the holders of which (under competent direction) will work on problems of commercial interest to the individuals who found the fellowships.

This plan is stated in the pamphlet to be in "imitation of the Mellon Institute of Pittsburgh". It differs, however, from the plan in operation at that Institution in two important particulars.

(a) According to the Royal Canadian Institute plan, negotiations with the manufacturer who provides the funds will be



carried out by an officer of the Royal Canadian Institute, while the responsibility for obtaining results satisfactory to the manufacturer will fall on officers of the Universities, i.e. on the professors in whose laboratories and under whose direction the investigation is to be carried out. Put briefly, promises are to be made by one body which it is left to the other to perform. There is no such divided responsibility in the Mellon Institute. Unless and until the Royal Canadian Institute has laboratories, staff and equipment of its own, the most it can do in this direction is to introduce the manufacturer to the proper university authority and leave the two to make their own arrangement.

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In other words, while the work is to be done in the universities, any fund that may be built up will be the property of an outside organisation. There is no such division of interests in the



Mellon Institute; work done there enhances the reputation of the institution and staff that carry out the work, and any funds that this reputation may attract are used to build up the staff and facilities of the institution where investigations are made.

To suppose that a serious investigation could be carried out by a young graduate at a small salary, independent of advice and assistance from those of more experience is absurd, and the more work of this kind that is undertaken, the larger will be the staff required. In the University of Pittsburgh of which the Mellon Institute is an integral part, the Department of Chemistry includes 14 professors, 13 assistant professors and 10 instructors; and the laboratory accommodation and facilities used for research alone are said to have cost over half a million dollars.

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Moreover, it is an essential feature of all paid work that he who pays expects definite results in a fixed time; so that if the results were not being obtained quickly enough by an undergraduate investigator, it would be almost necessary for some instructor to take the matter out of the student's hands, and reduce him to the position of a mere workman. Additional labour and anxiety would thus be thrown on the instructor, while the student would lose his opportunity of learning to carry on independent research, and with



it the main benefit to be derived from his final year in the University. The plan of avoiding expense by leaving the work to undergraduates must therefore be rejected.

As detailed later in this Report, a not inconsiderable amount of the kind of work contemplated by the Royal Canadian Institute has already been done and is now being done in the laboratories of this University. Any considerable extension of this work will involve increased expenditure, whether it be done under the Royal Canadian <sup>Institute</sup> plan or under any other plan, but it would be a most uneconomical use of public funds to spend them on purchasing land and erecting, heating and maintaining laboratories and supporting the clerical and scientific staff of a new institution.

In Canada very few of the industries have properly equipped laboratories of their own, and there are only two or three well supplied commercial consulting laboratories to which they may apply for temporary assistance. It is therefore natural that advice is commonly sought from members of this and other universities. Such advice and assistance is readily given whenever possible; for it is to the direct interest of the universities that those engaged in teaching applied science should keep in close touch with the realities of commercial life.

The Professor of Physics states that in regard to the proposal of the Royal Canadian Institute the policy that he has always followed since he became head of the laboratory should in his opinion apply, namely, to afford all properly accredited bodies and individuals whatever space and apparatus in the Physical Laboratory is in the opinion of the Director of the laboratory available for the purpose of the research such bodies or individuals wish to carry out.



The Professor of Biology states that the members of his Department would be glad to co-operate with the Royal Canadian Institute in the plan of Industrial Research if financial provision is made so that the scheme will be effective. At the present moment he thinks it is difficult enough to maintain the teaching programme, and that a good graduate student cannot be obtained at any moment a firm may see fit to grant us money, but only if the University has already developed a working plan of graduate appointments. Unless a special endowment or foundation is available, it is evident that the expense of maintaining the system will fall to the University.

The Associate Professor of Botany heartily approves co-operation with the Bureau of Industrial Research of the Canadian Institute, wherever, and whenever possible. Many industrial problems in mycology, zymology, wood-technology, shelter from injuries, etc., are wholly or in part botanical, and it will be valuable to us to be brought as closely as possible into contact with the needs of the industrial world wherever they touch our science.

Notwithstanding however the objections that have been pointed out with regard to the proposals of the Royal Canadian Institute the Science staff of the University is of opinion that the University should welcome the co-operation of the Royal Canadian Institute which might take these directions:

- (a) Interesting manufacturers in the application of science to industry.
- (b) Co-operating with the University in the endeavour to secure greater support from the Dominion and Provincial Governments in this regard.
- (c) Securing scholarships to be called the Royal Canadian Institute Research Scholarships to be held in the University under the direction of the Heads of University Laboratories.



The Science staff also desire to draw the attention of the Governors to the fact that a great deal of the kind of work described in the proposals of the Royal Canadian Institute has been done in the scientific laboratories and especially in the Faculty of Applied Science of the University of Toronto.

The Faculty of Applied Science make the following report as to the application of Science to Industry.

#### THE APPLICATION OF SCIENCE TO PROBLEMS OF INTEREST TO THE STATE OR TO A WHOLE INDUSTRY.

Such, for instance, are the exhaustive study of the mechanical properties of steel and the alloys, carried out by the German government at Crose-Licaterfelds; the elaborate investigation of the problems of tanning and leather manufacture carried out by the Leather Sellers Guild in London; and the important experimental work on the "cracking" of petroleum and the extraction of radium now in progress under the Bureau of Mines of the United States.

Work of this class done in the laboratories here is necessarily on a more modest scale; an idea of its amount and nature may be gained from the following partial list of investigations carried out in the laboratories of this Faculty during the last few years.

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obtained, usually leads to permanent employment. The work, however, is not paid for, and the results may be published. A few examples may be quoted:-

**Rubber:** A student who had spent his vacation in a rubber works on returning to the laboratory studied the methods of analysis and improved on one of them. He obtained a position with the company. This case is typical of half a dozen others.

**Wood distillation:** Four students on different occasions made a chemical study of certain by-products of the manufacture of wood alcohol, which at that time were regarded as waste products, and for the most part burned. Two of them obtained positions with a wood distilling company.

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This list could be extended to include an account of similar work on sugar, starch, sulphate of ammonia, synthetic drugs (vanillin, antipyrine, phenol, picric acid, etc.) paper pulp, coal gas, synthetic ammonia, formaldehyde, oils and fats, etc. etc. but those detailed above are sufficient to show the nature of the problems attacked. In some cases results were obtained, in others not.

Shortly before the war broke out the Engineering Alumni Association of this University founded two scholarships for industrial research. One of these in the Department of Electrical Engineering after two years experimental research, yielded results



of first rate importance regarding the operation of the hydro-electric 110,000 volt transmission lines; and as a result, after consultation with the Department of Electrical Engineering, the investigator was appointed engineer-in-charge of the laboratories of the Hydro-Electric Power Commission of Ontario. The other, which dealt with the recovery of resinous products from wood, was less successful. Financial conditions arising out of the war have led to the temporary suspension of these fellowships.

Suggestions for the extension of this work.

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Attention might be drawn to the communication of the Professor of Physics which says that the University first of all should take as wide a survey as possible of what are the needs of our country, propose a scheme to meet them and this will show how best our Universities can help in the movement.

If our University should take too narrow a view of the situation it may be that their proposals may not receive greater consideration than those brought forward by the Royal Canadian Institute.

The Faculty of Applied Science report as follows:

Any considerable extension of this work will necessitate provision for relieving members of the teaching staff of some of their present duties, and in some departments will require the provision of additional laboratory facilities. In other words, it will involve expense. Some of this additional expense might very properly be shared by the Dominion or Provincial Government.

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The establishment of such a Branch here seems the best way in which the Dominion Government could co-operate with this University in



promoting the application of Science to Canadian Industry.

In view of the interest in Industrial Research displayed by the Minister of Trade and Commerce an attempt might be made to procure funds for this purpose from the Dominion Government. Suggestions for the formation of a Royal Commission to carry on work of this kind in co-operation with the universities have already been laid before him, and these representations might be renewed.

(B) Co-operation with the Bureaus of the Government of  
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Ontario.  
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An attempt might be made to establish closer relations with the Provincial Bureau of Health (the Director of the B. H. is a Professor in this faculty), with the Provincial Bureau of Mines, and with the newly established laboratories of the Hydro-Electric Commission.

(C) The provision of distressed Assistants or Fellows might be considered by the University, the holders of which, under the direction of members of the staff, could carry to completion industrial researches already begun here, or others which could not be undertaken for lack of such assistance. This suggestion does not imply the immediate establishment of a large number of such assistantships, or that such as might be established should be allotted according to any symmetrical scheme. A plan of this kind has been found to work well in certain of the universities of the United States; at the University of Illinois, for instance, where an "Engineering Experiment Station" conducted by the University has been in successful operation since 1904, and has already published 80 Bulletins on "problems of importance to professional engineers and to manufacturing, railway, mining, constructional and industrial interests of the State."



THE APPLICATION OF SCIENCE TO PROBLEMS OF INTEREST TO  
INDIVIDUAL MANUFACTURERS OR CORPORATIONS ENGAGED IN INDUSTRIAL  
PURSUITS.

Owing to the absence of large suitably equipped commercial laboratories in this country which will probably not be provided until the manufacturers have been educated up to the necessity for them, it is obviously desirable that members of the Faculty of Applied Science, with the equipment at their disposal, should help in the application of science to the problems of the individual manufacturer - using that term in its widest sense. It is also clear that the manufacturer so helped ought to make some payment for the assistance received; more particularly because, as a usual thing, he objects to the publication of the results obtained, for fear that details of his business might thus become available to competitors.

In so far as they undertake work of this nature, the members of the Faculty constitute a body of skilled advisers whose assistance is available at low cost to the industries of the country.

The members of the Faculty of Applied Science desire herewith to submit the following incomplete list of problems that they have undertaken, which though it is partial will give an idea of the nature and extent of the work performed; because of the special interest attached to them, investigations arising out of the situation created by the war are placed at the head of the list.

See List 2



Suggestions for the extension of this work.

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It should be clearly understood from the outset, that if work of this class is to be materially extended, additional funds will be needed.

#### The Royal Canadian Institute Plan.

As already pointed out, the plan put forward by the Royal Canadian Institute differs from that in operation at the Mellon Institute, in that the Mellon Institute is an integral part of the University of Pittsburgh, while the Royal Canadian Institute Bureau is to be an independent body, looking to the universities for assistance in its work. The inconveniences arising out of this arrangement have been discussed already; in the present connection it is only necessary to point out that although under this plan the manufacturer would pay the salary of the investigator and provide him with material, the University would be expected to provide free of cost laboratory accommodation and facilities, as well as the time of its senior professors.



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UNIVERSITY OF TORONTO  
DEPARTMENT OF BIOLOGY

Feb. 4th., 1916.

President R.A. Falconer,  
University of Toronto.

Dear Mr. President;

In reply to your letter of Feb. 2nd., I am sure that the members of this Department would be glad to co-operate with the Royal Canadian Institute in the plan of Industrial Research if financial provision is made so that the scheme will be effective. At the present moment it is difficult enough to maintain the teaching program. Since there is no probability of the introduction into the Faculty of Applied Science of divisions devoted to applied work in Biology, I presume the plan would be to appoint Fellows to undertake the work, or in the case of commercial questions of a minor kind which would not be worth while for graduate students, to provide teaching assistance in order to set free members of the permanent staff for the work.

In discussing this question some appear to think that the provision of funds on the part of commercial firms would be all that is required. Personally I think this is a mistaken idea. A good graduate student cannot be obtained at any moment a firm may see fit to grant us money, but only if the University has already developed a working plan of graduate appointments. Unless a special endowment or foundation is available, it is evident that the expense of maintaining the system will fall fall to the University.

Yours sincerely,

*B. A. Brasley*



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BOTANICAL LABORATORIES

UNIVERSITY OF TORONTO

February 4th, 1916.

The President,

University of Toronto,

Toronto.

Dear President Falconer,

The Department of Botany heartily approves co-operation with the Bureau of Industrial Research of the Canadian Institute, wherever, and whenever possible. Many industrial problems in mycology, zymology, wood-technology, smelter fume injuries, etc., are wholly or in part botanical, and it will be valuable to us to be brought as closely as possible into contact with the needs of the industrial world wherever they touch our science.

Very truly yours,

*J. H. Faull.*



## University of Toronto.

## PRESIDENT'S OFFICE.

At a meeting of members of the Science Staff of the University of Toronto called to consider the proposal of the Royal Canadian Institute with regard to the establishment of a Bureau of Industrial Research it was resolved:-

That in the opinion of this meeting the proposal of the RCI as set forth in its printed circular is not feasible for the following reasons

(a)

But this meeting is also of opinion that the University should welcome the cooperation of the RCI which might take these directions

- (a) Interesting manufactures in the develop application of science to industry
- (b) ~~Endeavouring to~~ Cooperating with the university in the Endeavour to secure greater support from the Dominion & Provincial governments in this regard
- (c) Securing Scholarships for called the RCI research scholars within the field in the University under the direction of the Heads of their Labs